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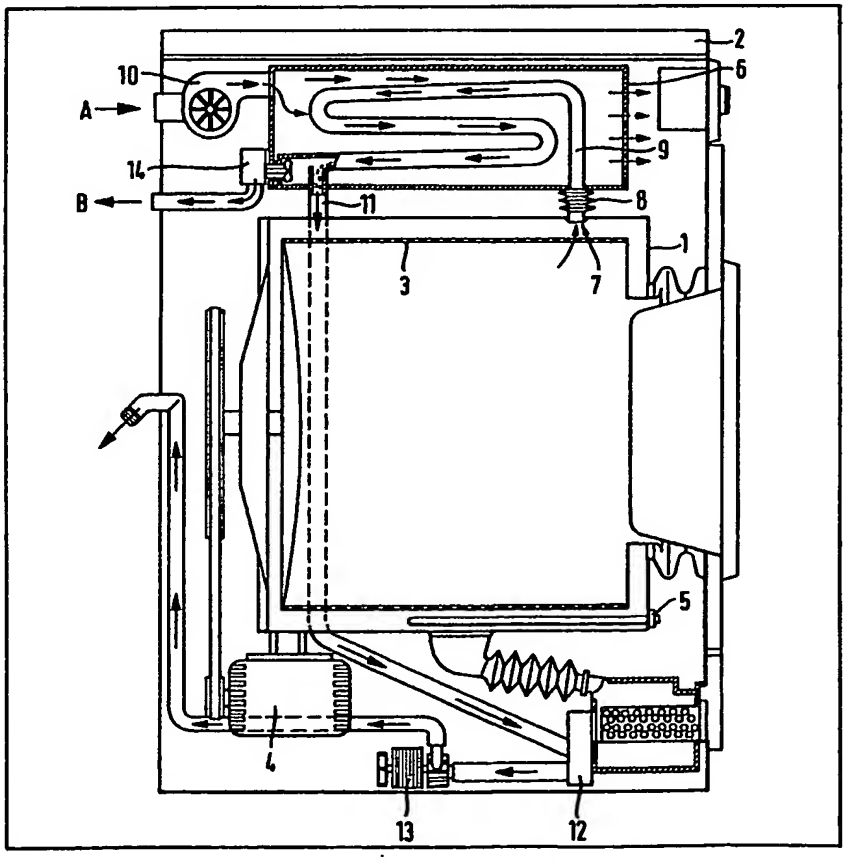
(54) Washing machine

(57) A washing machine of the drum-type for washing, spinning and drying laundry comprises a heater device (5), means (6) for condensing moisture removed from the washing during drying, and a liquor container (1), the heater device (5) being located in the lower region of the container (1) and providing the heating necessary during a washing step and radiant heat required during a drying step, the condensation device (6) being located above the liquor container (1) and being connected to the liquor container (1) by a steam outflow aperture (7) formed in the upper region of the liquor container (1) which aperture is traversed by the steam emanating from the drying laundry, the condensation device (6) being connected, through an outlet conduit (11) for the condensate formed therein, with a drainage device for the machine.



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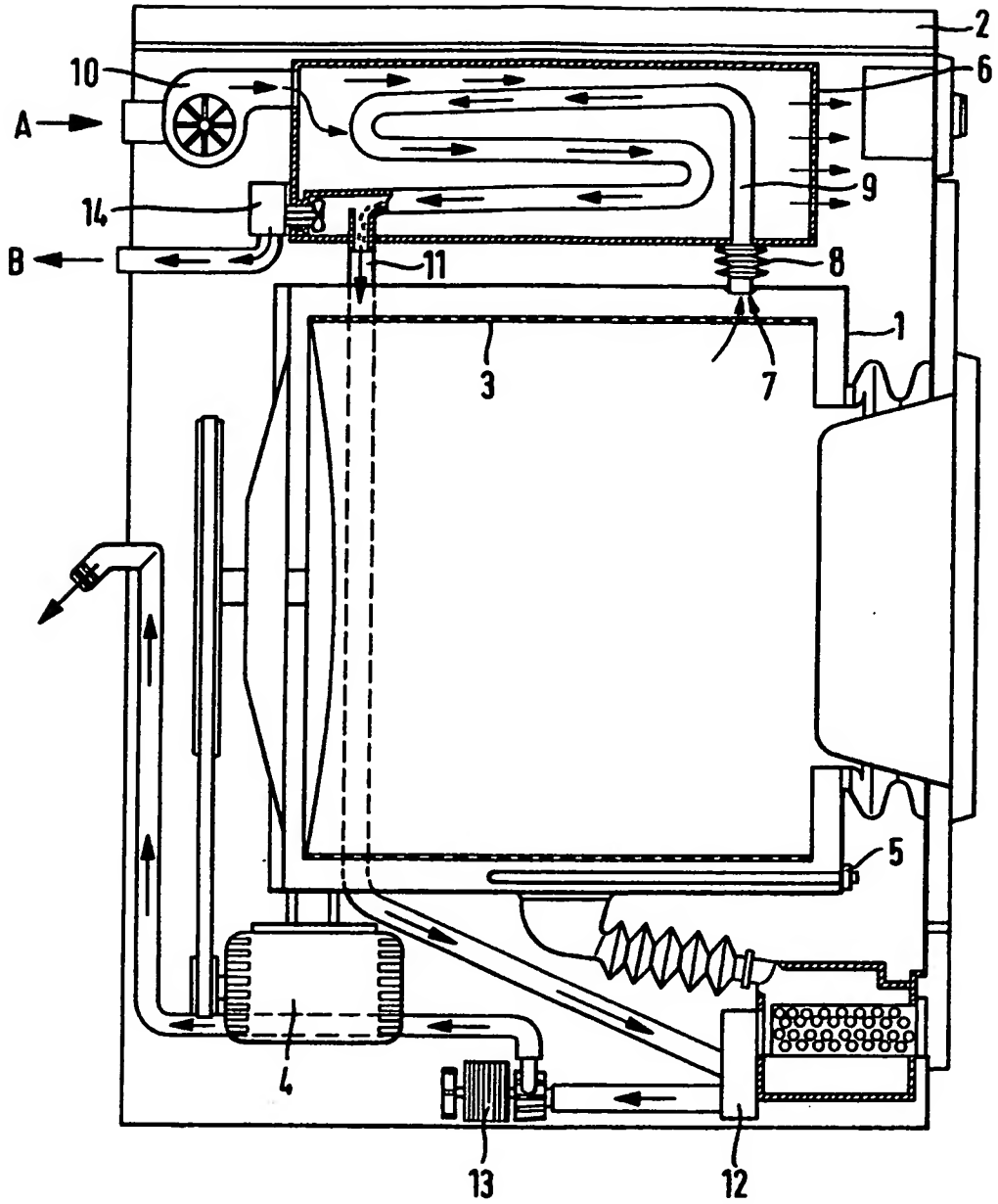
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SPECIFICATION
Washing machine

The present invention relates to a washing machine in which laundry can be washed, spun and dried, and more particularly to a drum-type washing machine. Such a machine is provided with a heater device and with means for condensing moisture emitted from the washing during the drying stage.

In machines in which combined washing and drying is possible, the drying stage following a washing stage has a number of problems connected therewith. On the one hand, heat must be supplied for evaporating the moisture contained in the washing but, on the other hand, cooling is necessary to cause condensation of the moisture to take place. It is believed that no drier at present on the market operates with a tenable, economic efficiency with regard to energy.

A drum washing and drying machine is known which operates on a radiation principle. The jet is located in the upper region of a liquor container forming part of the machine whilst the cooling surfaces for causing condensation are located in the lower region of the liquor container. Drying is effected using a blower so that a forced-conduction circulating airstream is produced. Such a machine combines the advantages of radiation heating and utlising circulating air. On the other hand, such a machine has the disadvantage that, in a circulating system in which heating and cooling occurs simultaneously, high losses of the sensible energy occur.

Attempts have been made to prevent such losses in a drier by separating heating circuit or cycle and the steam circuit or cycle. In such a device an unperforated washing drum is used which is heated by circulating heated air. The steam generated within the drum is extracted by means of a low-powered blower in a condenser located below the drum. This system allows a more favourable use of energy but is not really suitable for use as a drier for washing because of the unperforated drum.

The present invention therefore seeks to provide a drum washing and drying machine in which the drying process can be effected at an improved efficiency compared with known systems.

According to the present invention, there is provided a washing machine of the drum-type for washing, spinning and drying laundry comprising a heater device, means for condensing moisture removed from the washing during drying and a liquor container, the heater device being located in the lower region of the container and providing the heating necessary during a washing step and radient heat required during a drying step, the condensation device being located above the liquor container and being connected to the liquor container by a steam outflow aperture formed in the upper region of the liquor container which aperture is traversed by the steam emanating from the drying laundry, the condensation device being connected, through an outlet conduit for the condensate formed therein with a drainage device for the machine.

Such an arrangement in accordance with the invention appears to provide a number of advantages. Because the heater acts on the radiation principle, an intensive supply of heat is ensured which results in a high rate of evaporation of the moisture in the washing. The steam or water vapour discharged from the liquor container contains a high proportion of moisture and only a small proportion of air, which favours the condensation thereof and minimizes heat dissipation.

One embodiment of a washing machine in accordance with the present invention is shown schematically and by way of example in the accompanying drawing, the single Figure showing a side elevation, partially in section, of a front-loading washing machine.

In the Figure, there is shown a washing and drying machine 2 comprising a liquor container 1 in which a drum 3 for receiving washing is rotatably mounted in a conventional manner. The drum 3 is driven by a drive motor 4. In the lower region of the liquor container 1, a heating device 5 is located. The device may comprise a plurality of juxtaposed tubular heater elements. In a preferred embodiment, three such tubular heater elements are provided. The heater elements are desirably electrical and, by connecting two of them in series, the necessary heating for the washing operation is produced whilst the series connection of three heater elements causes a reduction in the current flowing and hence in the heat output. Hence three series-connected elements forms a suitable heating source for a drying process. The necessary heat transfer for drying the washing occurs by radiation whilst the drum 3 is in motion.

An air-cooled condenser 6 is accommodated in a housing of the machine and is located above the liquor container 1. Although a water-cooled condenser could be used but air cooling is preferred because it avoids water consumption. The condenser 6 communicates with a steam outlet opening 7 provided in an upper region of the liquor container 1. The steam given or driven off from the washing during the drying process is conducted through a bellows-like conduit 8 into the cooling coil 9 of the condenser 6. The condenser 6 is impacted with coolant air through a coolant air blower 10. The steam which rises into the coolant coil 9 condenses and the condensate thus produced flows through a discharge conduit 11 into the slub filter housing 12 of the machine. From the filter housing 12, the condensate may be pumped away by means of a pump 13 which is synchronised in the preferred embodiment. During discharge of the steam generated in the liquor container, the natural tendency thereof to rise is utilised. To maintain the steam flow, a relatively weak blower 14 may therefore be used. In any case, it is desirable only to extract saturated steam through a relatively small steam discharge aperture 7, since this

removes a minimum of energy from the drying process. Moreover, if saturated steam is used, the condensation is considerably enhanced.

The individual blowers 10 and 14 could be combined into a single blower unit in which, for example, the drive motor of the blower for the coolant air coaxially carries the fan blades of the steam extractor blower.

Induction of the coolant air, in the direction of arrow A, preferably takes place in the rear region of the drier. After passing through the condenser 6, the coolant air may be exhausted from the front of the washing machine. On the other hand, the coolant airstream could be conducted through the housing of the machine and exhausted from the lower region of the drier in which case it could be used to cool components of the machine which may overheat.

The weak air discharge stream, occurring in the direction of arrow B is conveniently exhausted from the rear of the machine.

CLAIMS

1. A washing machine of the drum-type for washing, spinning and drying laundry comprising a heater device, means for condensing moisture removed from the washing during drying and a liquor container, the heater device being located in the lower region of the container and providing the heating necessary during a washing step and radient heat required during a drying step, the condensation device being located above the liquor container and being connected to the liquor container by a steam outflow aperture formed in the upper region of the liquor container which aperture is traversed by the steam emanating from the drying laundry, the condensation device being connected, through an outlet conduit for the condensate formed therein, with a drainage device for the machine.

2. A washing machine as claimed in claim 1, wherein the heater device comprises three juxtaposed electrical heating elements, two of said elements connected in series providing the heat necessary for a washing step and the three elements connected in series providing the heat necessary for a drying step.

3. A washing machine as claimed in claim 1 or 2 wherein the condensation device is an air-cooled condenser which is impacted with coolant air supplied by a blower device, the condenser including a cooling coil through which air saturated with water vapour rising from the liquor container is conducted.

4. A washing machine as claimed in claim 3 wherein a further blower device is provided to assist the transfer of the water vapour from the liquor container to the cooling coil.

5. A washing machine as claimed in claim 3 or 4 wherein the condenser is connected to the liquor container.

6. A washing machine as claimed in any preceding claim wherein the condensate formed in the condensation device is conducted into a slub filter housing and pumped away, in synchronism, by a liquor pump.

7. A washing machine as claimed in any one of claims 3 to 6 wherein the coolant air stream leaving the condenser is conducted through the interior of the housing of the machine to cool parts of the machine liable to overheat and is exhausted in the lower region of the machine.

8. A washing machine constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

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